**Overview of Drought Task Force Research Objectives**

NOAA's Drought Task Force aims to achieve significant advances in the ability to monitor, understand, and predict drought over North America. Research results produced by members of the Task Force are expected to help advance official national drought products, the development of early warning systems by the National Integrated Drought Information System (NIDIS), and experimental drought monitoring and prediction activities at the National Centers for Environmental Prediction (NCEP). The Task Force will coordinate with other relevant national and international efforts including the emerging National Multi-Model Ensemble (NMME) capability and the international effort to develop a Global Drought Information System (GDIS).

Progress will largely be made through the achievements of individual MAPP-funded research projects; however, the task force has defined coordinating activities that are meant to facilitate the advancement of the overall research goals. In particular, the task force has developed a Drought Test Bed that individual research groups can use to test and evaluate methods and ideas. Central to the Task Force's approach is a focus on three high profile North American droughts – the 1998-2004 Western US drought, the 2006-2007 Southeast US drought, and the 2011-current Tex-Mex drought. The Task Force's overarching goals are to facilitate collaboration among projects, develop metrics to assess the quality of monitoring and prediction products, and develop an experimental drought monitoring and prediction system that incorporates and assesses recent advances.

In the following we describe the issues underlying our key research objectives in more detail.

1*) Understanding North American Drought*

While a primary goal is to improve drought prediction, advancing understanding of the mechanisms of drought is critical to advancing modeling capabilities and assessing how the global climate can influence regional conditions. Substantial progress has been made recently to understand the influence of sea surface temperatures (SSTs) in regions far removed from a drought. Nevertheless, some aspects of the influence of global climate conditions on regional drought are still poorly understood, including the impacts of the different ocean basins and the physical mechanisms by which the SST forcing leads to regional hydrological anomalies. These physical mechanisms include changes in atmospheric circulation and moisture transport as well as feedbacks from the land. These processes manifest themselves in large variations in the character of drought (*e.g.*, timing with respect to the annual cycle, frequency, length, intensity, geographical heterogeneity) even with the same large scale forcing. This is indicative of the dependence on the local "background" climatological atmospheric and land conditions as well as the annual cycle.

The focus on three different droughts serves to highlight regional differences and should help ensure that any improvements in modeling capabilities are robust. In addition, by assessing commonalities and differences between the droughts and conducting hindcast and other sensitivity experiments, we will be able to better understand the limits to predictability and the potential for early warning in the different regions.

2*) Improving Drought Monitoring*

Improvements in our drought monitoring capabilities must consider both scientific issues and user applications. Underlying many of the issues is the fact that there is no single definition of drought used across the community. For example, meteorological, agricultural, and hydrological drought are measured by deficits in precipitation, soil moisture, and stream flow, respectively. Progress in monitoring drought requires metrics that can be used to quantify improvements. The success of the US Drought Monitor's approach of providing a blend of different drought indicators (informed by expert judgment) reflects the end user's desire for simplicity but also highlights the scientific challenge of how to assess the quality of monitoring that can both inform users and be evaluated to facilitate improvements.

Progress will be measured by taking a more holistic approach to monitoring (and prediction) by examining the ability to measure and predict the onset, severity, and phasing of drought as opposed to a meteorological or hydrological variable. Rather than only measuring aggregate outputs of systems (*e.g.*, stream flow), we will also examine the driving components (*e.g.*, snowpack). Aspects of the system's behavioral performance including elasticities, persistence, and the ability to reproduce the observed variability will be examined. The robustness of improvements can be effectively assessed through the three very different North American drought cases described earlier.

3*) Improving Drought Prediction*

Improved drought prediction is the key to developing a useful drought early warning system. Central to this effort is improving the prediction of precipitation on intraseasonal to seasonal and longer time scales. The usefulness of improved precipitation forecasts (especially necessary in the warm season) will depend on the extent to which predictable signals in soil moisture and stream flow emerge. Currently, the accuracy of hydrological forecasts extending out one or two months is a result of the hydrological system's memory of the initial conditions (*e.g.*, soil moisture, snow). Little additional improvement is gained from forecasts of precipitation, with the exception of precipitation patterns influenced by the occasional strong ENSO event. Studying the three designated Northern American drought cases can help illuminate the influence of initial hydrological conditions and precipitation forecasts on regional heterogeneity of drought. The extent to which these improvements lead to useful and actionable information in the variables and at the spatial scales of importance to users will be assessed.

The task force applies a wide array of tools towards the goal of improving drought prediction including coupled climate models, very high-resolution atmospheric and land models, hydrological models, and various data sets for initializing and validating the model results. Accordingly, various individual research projects will address the challenges described above from different perspectives. The Task Force Test Bed will play a coordinating role.